

SURVEY OF TRIBUTARIES TO SALT SLOUGH
MERCED COUNTY, CALIFORNIA

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August 1990

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
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Special thanks goes to the land owners whose cooperation
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SUMMARY

Salt Slough serves as a conveyance for subsurface agricultural drainage from its tributaries to the San Joaquin River. A detailed appraisal of the slough tributaries was conducted to determine their actual use and operation and how these might influence water quality in Salt Slough. The Slough has three major tributaries; Salt Slough Ditch, West Delta Drain and Mud Slough (south).

Each of these tributaries has several tributaries, some of which carry subsurface agricultural drainage water. The water quality of all these flows is highly influenced by management decisions which result in manipulation of the water system. For example, Mud Slough (South) is influenced by Grassland Water District, Central California Water District and San Luis Canal Company operations, while Salt Slough Ditch and the West Delta Drain are influenced by operations in either the San Luis Canal Company or the Poso Canal Company. Because of this operation and the large fluctuations in water quality, the beneficial uses of the tributaries to Salt Slough stand alone and can not be considered to be the same as the beneficial uses of the slough itself.

INTRODUCTION

Salt Slough is located in Merced County in the San Joaquin Valley, and is a tributary of the San Joaquin River (Figure 1). It originates at the Sand Dam near the confluence of Salt Slough Ditch and West Delta Drain (SE1/4, SE1/4, NE1/4, Sec.21, T.9S, R.11E, MDB&M). From here, Salt Slough flows northwestward and discharges to the San Joaquin River approximately 3.5 miles upstream of Fremont Ford State Park (NE1/4, NE1/4, SW1/4, Sec.29, T.7S, R.10E, MDB&M). Salt Slough is a typical valley floor slough. It has a very small slope; it meanders and is generally shallow and slow moving except during periods of exceptionally high flow. Its principal tributaries are Salt Slough Ditch, Mud Slough(south) and West Delta Drain.

Salt Slough drains the area west of the San Joaquin River. Its flow originates in the surrounding districts such as San Luis Canal Company, the Central California Irrigation District, Poso Canal Company and the Grassland Water District as well as from areas upslope of the Grassland Water District that discharge through the Grassland Water District to Salt Slough. These upslope areas consist of Panoche Drainage District, Pacheco Water District, Broadview Water District, Charleston Drainage District and Firebaugh Canal Water District. During the winter and early spring its flows are a mixture of subsurface agricultural drainage, precipitation runoff and discharges from local duck clubs and wildlife refuges. During the summer and fall its flows are made up of agricultural tailwater, irrigation district spill water and subsurface agricultural drainage.

Salt Slough is one of the two major sources of subsurface agricultural drainage pollutant load to the San Joaquin River. However, very little subsurface drainage is produced in the vicinity of Salt Slough. The large majority of the subsurface drainage is actually produced south of the Grassland Area and transported north through the South Grasslands to Salt Slough via the San Luis Canal, Santa Fe Canal and Mud Slough (south). In this manner, Salt Slough simply serves as a conveyance for the subsurface agricultural drainage from its tributaries to the San Joaquin River (Pierson et al., 1989, and James et al., 1988).

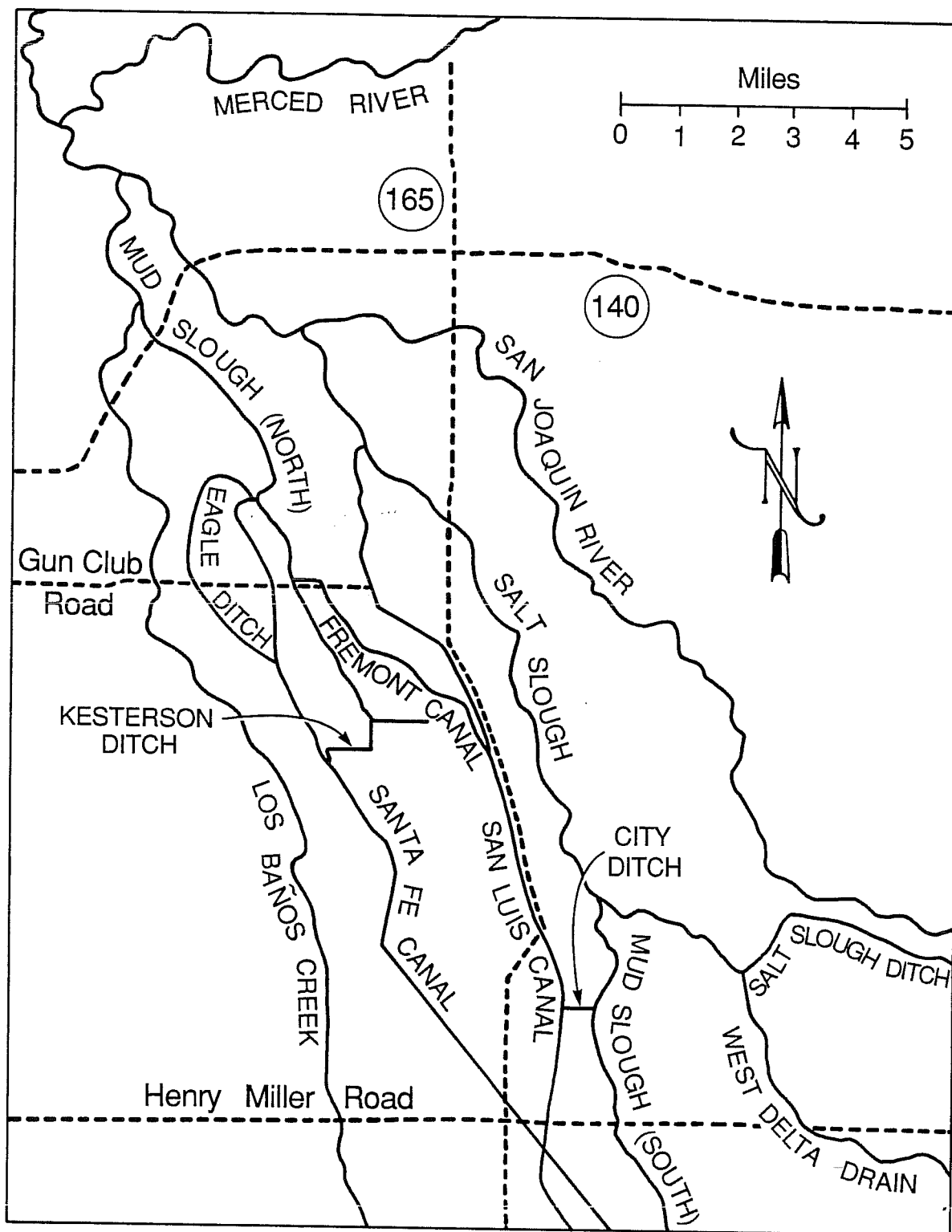


Fig. 1. Location Map

To help control the discharges of subsurface agricultural drainage, it has been proposed that Salt Slough be added to the list of 28 surface water bodies in the San Joaquin River Basin Plan. In so doing, Salt Slough would be assigned certain water quality objectives. As stated previously, the large majority of subsurface agricultural drainage is actually discharged to the tributaries of Salt Slough. Therefore, to assist in maintaining Salt Slough's water quality objectives information about its tributaries' hydrologic and operational features as well as water quality need to be obtained.

In addition to water quality objectives, the basin plan would assign specific beneficial uses to Salt Slough. As a general rule, basin plans assume the same beneficial uses for tributaries as the water body to which they are tributary.

However, this is not an accurate assumption for the Salt Slough tributaries. Because the Slough's major tributaries are maintained as man-made or man-altered agricultural drainage channels, they do not provide the same beneficial uses as Salt Slough. Therefore a detailed appraisal of these tributaries needs to be initiated to determine their actual beneficial uses and how to best maintain the water quality objectives of Salt Slough.

This report represents the first step in the appraisal of Salt Slough's major tributaries; Salt Slough Ditch, West Delta Drain, and Mud Slough (south). This study was initiated to physically characterize each of the tributaries and to identify all discharges and diversions to or from them. In addition, it was to provide hydrologic information about each tributary and how they operated. Lastly, this study was to provide some insight into the water quality of each tributary. The goal of this study was to provide information that could be used in assessing the beneficial uses of the tributaries and in the maintenance of Salt Slough's water quality objectives.

METHODS

There were a number of methods used in gathering information for this study. Initially, the major tributaries of Salt Slough were identified from information in Regional Board files (Pierson et al., 1989). Additional information was obtained from U.S. Geological Survey Topographical Quadrangles and discussions with personnel from Grassland Water District, San Luis Canal Company, Central California Irrigation District, and the California Department of Fish and Game. Water quality data was obtained from Regional Board reports and District files. Lastly, surveys of each tributary's entire length were conducted during the summer of 1988.

The surveys consisted of travelling the entire length of each tributary and noting the location and type of all discharges, diversions and hydraulic structures. The type of in-channel vegetation and surrounding land use was also noted. In addition, photographs showing the physical characteristics and significant discharges and diversions of each tributary were taken and are available in Regional Board files.

FINDINGS

PHYSICAL CHARACTERISTICS

The following is a discussion of the physical characteristics of each of Salt Slough's major tributaries. It discusses the type of vegetation in and around each tributary as well as surrounding land use. In addition, it describes the major discharges and diversions of each tributary. Lastly, it discusses the number and type of each minor discharge and diversion for each tributary.

A detailed index of the minor discharges and diversions of each tributary are given in Appendix A. The index identifies each discharge and diversion site by a unique site number, locates the site in miles from the tributary's origin, and describes the type of discharge or diversion site. The discussion that follows will move from upstream to downstream. Of the three major tributaries, two, Salt Slough Ditch and the West Delta Drain enter at the beginning of Salt Slough and it is their flow that has made the present starting point for Salt Slough which originally was an overflow flood channel of the San Joaquin River. Agricultural development in the area in the early part of this century removed any signs of the old channel and its flow and present characteristics are the result of irrigated agricultural return flows.

Salt Slough Ditch

Salt Slough Ditch is a combination of a man-made channel and a natural channel, which runs from the confluence of Wood Slough and Santa Rita Slough to a point just south of Hereford Road where it discharges to Salt Slough. It is used as both a drain and an irrigation canal by the San Luis Canal Company. A very large area is drained by Salt Slough Ditch. This drainage flows westward where it may be pumped into any of several irrigation supply canals or ditches. The drainage flow is both surface and subsurface as well as some irrigation spill water. For a large majority of its length Salt Slough Ditch is lined by agricultural cropland on either side.

Salt Slough Ditch begins just north of the confluence of Wood Slough and Santa Rita Slough. Both Wood Slough and Santa Rita Slough are channels which carry surface and subsurface agricultural drainage and irrigation spill water. At this intersection, the water is siphoned under a canal and is considered the starting point for Salt Slough Ditch. At this point water may be pumped into Orchard Ditch for reuse. Salt Slough Ditch ends at Sand Dam as it flows over a weir and into Salt Slough. This point is approximately 0.5 miles west of Hereford Road.

There are 119 discharges to Salt Slough Ditch. Five of these are major tributaries; West Santa Rita Drain, San Juan Drain, Poso Drain, Belmont Drain and Wood Slough and Santa Rita Slough just below their confluence. Six of the discharges are irrigation spills from San Luis Canal Company canals and ditches. Two of these six are return spills from lift pumps which take water from Salt Slough Ditch (i.e. it is the same water). Eighty-two of the discharges are small field drains. Of these 82; 47 enter from the north and east sides (right bank when looking downstream) and 35 enter from the south and west (left bank when looking downstream). The remaining 26 discharges are larger field drains draining one or more large fields. Of these 26; 15 enter from the north and east and 11 enter from the south and west. These discharges drain crop land with a variety of different crops. These include cotton, alfalfa, sugar beets, cantaloupe, tomatoes and pasture land. The largest crop areas are cotton and alfalfa.

The Belmont Drain, one of the main tributaries, discharges to Salt Slough Ditch just upstream of the Delta Canal Crossing of the Slough. The Belmont Drain drains agricultural cropland in the northwest portion of the San Luis Canal Company. The drain carries agricultural tailwater and irrigation district spill water.

The West Santa Rita Drain, another main tributary, enters the Ditch approximately 1 mile west of Elgin Avenue. The San Juan Drain enters the Ditch approximately 2 miles west of Elgin Ave. These discharges drain a major portion of the eastern half of the San Luis Canal Company. The San Juan Drain carries surface drainage and a small portion of subsurface agricultural drainage as well as irrigation district spill water. The West Santa Rita Drain carries a very small portion of subsurface agricultural drainage, but does carry surface drainage and irrigation spill water.

The Poso Drain, the final major tributary, enters Salt Slough Ditch at its intersection with Turner Island Road. The Poso Drain is a large drain draining the central portion of the San Luis Canal Company as well as most of the Poso Canal Company which is the draining entity for part of the Central California Irrigation District. The Poso Drain may carry both surface and subsurface agricultural drainage as well as irrigation district spill water.

There are 14 permanent and 3 temporary diversions from Salt Slough Ditch. All of these are via lift pump. Four of these provide water to the San Luis Canal Company canals; Orchard Ditch, San Juan Canal, Island Canal, and Delta Canal for use as irrigation water. One of the pump stations delivers water to Siphon Ditch. This water is used as irrigation water on the east side of the San Joaquin River. The remaining 11 lift pumps provide water to small ditches and used for irrigation of surrounding crop land. Three of these are portable lift pumps.

West Delta Drain

The West Delta Drain is a man made agricultural drain. It runs from immediately north of Highway 152 on Cozzi Road to the beginning of Salt Slough at Sand Dam. It begins as a small open channel paralleling Lone Tree Canal then becomes deeper and wider further downstream. For most of the drain's length dirt roads follow its banks on both sides. The drain in many places contains tules and weeds. Most of the banks are lined with weeds along the entire length. The final 0.8 miles appears to be a naturally occurring channel. This section of the drain is lined along both sides with grasses.

The West Delta Drain begins near Cozzi Road approximately 0.75 miles north of Highway 152. From this point it flows northwestward to Salt Slough. It enters the slough from the southeast just downstream of Sand Dam. At this point the flow will usually enter the slough by gravity but it may be pumped into Salt Slough Ditch just upstream of Sand Dam.

The West Delta Drain is an agricultural drain. It drains a fairly large area in the western portion of the San Luis Canal Company. Of the crops grown in this area, cotton and alfalfa are the most prevalent.

The majority of discharges to the West Delta Drain (58 to 75) are small field drains which drain either small fields or parts of larger fields. All of these are gravity discharges flowing through the bank via pipes to the drain. Of these drains 33 enter the drain from the northeast (right bank when looking downstream) side and 25 from the southwest (left bank) side. Of the remaining 17 discharges, 11 are larger field

drains. These drains are fairly large open ditches draining a number of fields. They drain much larger areas than do the small field drains.

Two of the discharges are large drains from the Los Banos Wildlife Refuge. One of them is a pipe to the drain from an open channel. The other is an open channel entering the slough via a large gate structure.

The remaining four discharges to the Drain are irrigation spills. Approximately 0.8 miles south of Salt Slough confluence the West Delta Canal overcrosses the drain via pipeline to the Los Banos State Waterfowl Management Area. At this point, water may spill from the canal into the drain. At the point where the West Delta Drain undersiphons the West Delta Canal, the canal may spill into the drain. Just east of Box Car Road a gated structure may allow spill from the West Delta Canal to the drain. Approximately 0.5 miles from the beginning of the drain the Lone Tree Canal may spill into the drain via a gated structure.

There are two lift pumps on the drain. One of them lifts water from the drain to Salt Slough Ditch just upstream of Sand Dam. The second pump is just south of Henry Miller Road. The pump may lift water from the drain into the West Delta Canal for reuse just before the drain undersiphons the canal.

Mud Slough (south)

Mud Slough (south) begins just south of the Los Banos Gun Club. The Slough begins at the end of the Camp 13 Ditch. There is no clear delineation between where Camp 13 Ditch ends and Mud Slough (south) begins. From this point it flows northward along a natural course that has been deepened to the Santa Fe Grade Road. At this point virtually all of the flow is diverted into the Mud Slough Bypass. The Mud Slough Bypass parallels the Santa Fe Grade Road in a northwestward direction and enters the Santa Fe Canal just downstream of Mueller Weir. At the beginning of the bypass a large gate valve allows water to flow under the Santa Fe Grade Road and continue on its natural course thru Mud Slough (south). Water is allowed to flow through the culvert under Santa Fe Grade only to provide a minimal amount of stockwater to the property on the East side of the Grade or to relieve flooding conditions upstream on Mud Slough. The Slough then flows northward through pasture land to Henry Miller Road undersiphoning the Agatha and Arroyo Canals along the way. At the Agatha Canal a gated structure allows water to be spilled into the slough. North of Highway 152 and south of Henry Miller Road the slough meanders greatly and has many branches and fingers. There are a number of duck ponds in this area (this would be most of discharges in this stretch). The remainder of the length is entirely within the Los Banos State Waterfowl Management Area. A number of large discharges enter the slough in this stretch. These include the Santa Fe Diversion, City Ditch and the Boundary Drain. There are also a number of pond drains in this reach. Mud Slough (south) then enters Salt Slough approximately 2/3 mile south of the San Luis Ranch at Wolfsen Road.

South of Highway 152 there are 5 or 6 discharges to Mud Slough (south). These include Camp 13 Ditch and Gadwall Canal. One of the discharges drains a large pond. A fourth discharge is a gated outlet from the Agatha Canal to Mud Slough (south) which is used for stockwatering and is also used on an intermittent basis by two farming operations and at least one duck club situated along Mud Slough north of Highway 152. The fifth discharge is from the Makin tile drain just north of the bypass. The sixth is a large gate to an open ditch which can flow either into or out of the slough.

Camp 13 is the beginning of Mud Slough (south). It is the major input for the southern portion of Mud Slough (south). Camp 13 may receive both surface and subsurface agricultural drainage water as well as irrigation spill water from a large area to the south. These areas include the water districts of: Broadview, Mercy Springs, Panoche, Pacheco, San Luis, and the Firebaugh Canal Company and Central California Irrigation District. Camp 13 ditch carries duck pond drainage in winter and early spring. In the fall it is used to carry water to duck clubs in the area.

Also entering the slough in the southern portion is the Gadwell Canal. It is similar to the Camp 13 Ditch in that in the spring and summer, it carries surface or subsurface agricultural drainage. It is used in the fall to convey water to duck clubs. In the winter and early spring flows consist mainly of duck club drainage

Between Henry Miller Ave and Highway 152 the slough is inaccessible. Most of this area consists of a meandering Mud Slough (south) and duck ponds. Any discharges in this area are mainly local drains most likely from duck ponds. At least two farming operations also discharge into Mud Slough (south) north of Highway 152. It should also be noted that a development project has been proposed which include a municipal golf course and more than 1900 homes on 640 acres immediately north of Highway 152 adjacent to Mud Slough south. Although the project plans are not yet finalized, the project proponents have indicated they plan to alleviate a high water table problem by discharging to Mud Slough. Excess storm runoff is also proposed to be discharged to the Slough.

North of Henry Miller Ave all of the Slough is within the boundary of the Los Banos State Waterfowl Management Area. Within this area there are 18 discharges to the Slough. Of these, 13 are drains from duck ponds. Of these, 10 are pipes into the slough and 3 are gated structures. Of the remaining 5 discharges, 3 are City Ditch, Boundary Drain and the Santa Fe Diversion Canal. Of the final 2 one is a drain (pipe) from pasture land and the other is spill water from the San Pedro Canal.

City Ditch is a man-made channel designed to carry water from the San Luis Canal to Mud Slough. Water is not diverted from the City Ditch onto the Los Banos State Waterfowl Area. The sole purpose of the City Ditch is to convey wastewater (agricultural return flows from the upslope drainers and storm runoff from the City of Los Banos) to Mud Slough. In the past few years, City Ditch has been the point of major discharges of subsurface agricultural drainage water originating to the south of the Grassland Area. Because of the year round high flow being experienced, a major realignment of this system was completed in 1987.

The Boundary Drain is a large man-made agricultural drain. It receives flow from the San Luis Canal Company and the Central California Irrigation District. It contains mainly surface agricultural drainage and irrigation spill water. It contains very little subsurface agricultural drainage and is usually of fairly good quality. The Boundary Drain flows by gravity into Mud Slough (south) in Los Banos State Waterfowl Management Area. However, when the Santa Fe Diversion Canal is operating an earthen dam is placed across the Boundary Drain to prevent backup into the Boundary Drain by Mud Slough (south). Water is then pumped from the Boundary Drain to Mud Slough (south).

Santa Fe Diversion Canal is a man-made channel designed to carry water from the Santa Fe Canal to Mud Slough (south) before the Santa Fe Canal water mixes with the San Luis Canal water. This was built as a temporary structure to divert the subsurface drainage water from the North Grassland area. This canal will be abandoned in 1990 or converted

to a freshwater flow when alternate plans for the subsurface drainage water are implemented.

There are 3 diversions from the slough (all south of the Arroyo Canal). The first is the Mud Slough Bypass. The second is a lift pump to a duck pond north of the Los Banos Gun Club. The third is a lift pump used to irrigate pasture land just east of the bypass. The Mud Slough Bypass is a man-made channel designed to carry water from Mud Slough (south) to the Santa Fe Canal. Water may pass to the original Mud Slough channel by a gate valve. However, virtually all of the flow is directed to the bypass.

OPERATION

The tributaries of Salt Slough are a complex network of canals and ditches. The reason for the complexity of the system is that it is used for different purposes (sometimes incompatible) throughout the year. In the spring and summer it is used to convey agricultural drainage south of the Grassland Water District (GWD) to the San Joaquin River. In the fall it is used to supply relatively good quality water to local gun club duck ponds. In the winter and early spring it is used to drain the duck ponds. The following is a discussion as to how each of the three tributaries of Salt Slough is operated under each of the above circumstances.

Salt Slough Ditch

The Salt Slough Ditch is owned and operated by San Luis Canal Company. It is used primarily to convey surface and subsurface agricultural drainage and irrigation spill water. The ditch functions year round as both a drain and an irrigation canal. A large portion of San Luis Canal Company drains into Salt Slough Ditch. The water flows northwest and may be pumped into any of several irrigation supply canals or ditches. Water not being used flows over a weir and into Salt Slough.

West Delta Drain

The West Delta Drain is owned and operated by San Luis Canal Company. It is used primarily to convey surface agricultural drainage and irrigation spill water. The Drain is operated year round to drain a large area in the western portion of San Luis Canal Company. The water flows northwest and can be pumped into Salt Slough Ditch just upstream of Sand Dam and into West Delta Canal for reuse.

Mud Slough (south)

Mud Slough (south) is a naturally occurring channel which has portions of it used to convey surface and subsurface agricultural drainage water as well as irrigation spill water to Salt Slough. The most southern portion of Mud Slough (south), which has been deepened, receives drainage year round from Camp 13 Ditch and Gadwall Canal. This portion of the slough conveys drainage north approximately two miles into the Mud Slough Bypass. At this point, drain water is diverted into the Santa Fe Canal.

Mud Slough (south) from the Mud Slough Bypass to Henry Miller Road is used primarily to convey limited amounts of surface drainage and subsurface seepage from pasture land and a number of duck ponds that drain in the winter and early spring.

Although the northern section of Mud Slough (south) from Henry Miller Road to Salt Slough is a natural channel, it is used primarily to convey surface and subsurface agricultural drainage. The water enters this section from two locations.

Most of the year, drainage water flows from the Santa Fe Canal to the San Luis Canal. From the San Luis Canal, agricultural drainage is conveyed through the City Gates and into the northern portion of Mud Slough (south) approximately two miles north of Henry Miller Road. This section of the slough conveys this water north to Salt Slough.

In the fall and ten day periods in February, May and June, the northern section of Mud Slough (south) from the Santa Fe Diversion just south of Henry Miller Road to Salt Slough is used as the primary conveyance of surface and subsurface agricultural drainage from land south of the Grassland Water District. Drainage is diverted from the normal San Luis Canal route in order to supply good quality water to duck ponds in the Los Banos Waterfowl Area via the San Luis Canal. During this time, the City Gates are closed and water is diverted from the canal to the duck ponds at several sites. In addition, the Boundary Drain pumps surface agricultural drainage into the slough which would normally flow in by gravity.

WATER QUALITY

The Agricultural Unit of the Regional Board periodically samples sites in the Salt Slough tributary system to monitor water quality. In addition, water and irrigation districts in the area do periodic sampling. Water quality results for selected constituents at various sites are given in Appendix B. Figure 1 shows the relative locations of these sites with site identifications corresponding to the Table numbers in Appendix B. The four constituents; electrical conductivity (EC), boron (B), selenium (Se), and molybdenum (M) are presented because they are the most representative of subsurface agricultural drainage and they are included in the basin plan water quality objectives for Salt Slough. Water quality data presented in this report is taken from James et al., 1988 and district reports.

Salt Slough Ditch

Table 1 in Appendix B shows water quality data for Salt Slough Ditch at Hereford Road. The constituent concentration is relatively low during the entire year. The low concentrations throughout the year indicate that very little, if any, of the flow contains subsurface agricultural drainage water. Therefore, Salt Slough Ditch should not be considered a major contributor to Salt Slough's subsurface agricultural drainage pollutant load.

Table 1 Median Constituent Concentrations for Grassland Area Drains During Water Years 85, 86, 87 and 88 (Chilcott et al., 1989)

Monitoring Site Water Year	EC <u>μmhos/cm</u>	B <u>mg/L</u>	Se <u>μg/L</u>	Mo <u>μg/L</u>
Salt Slough Ditch at Hereford Rd				
Dry WY 85	850	0.37	1.0	--
Wet WY 86	785	0.33	1.0	<5
Critical WY 87	1000	0.39	1.4	3
Critical WY 88	1150	0.38	1.2	5
City Ditch				
Dry WY 85	2100	3.1	18	--
Wet WY 86	2600	4.1	27	6
Critical WY 87	3110	3.8	41	11
Critical WY 88	3280	4.4	39	--
Santa Fe Canal-Mud Slough Diversión				
Dry WY 85	---	---	---	--
Wet WY 86	2550	3.9	27	11
Critical WY 87	2780	3.9	44	11
Critical WY 88	2800	3.9	38	--
Boundary Drain				
Dry WY 85	1090	0.45	1.0	--
Wet WY 86	1710	0.65	1.0	6
Critical WY 87	1250	0.54	1.6	4
Critical WY 88	1470	0.50	1.4	6
Camp 13 Slough				
Dry WY 85	2550	3.4	32	4
Wet WY 86	2950	3.9	43	--
Critical WY 87	2650	3.7	43	6
Critical WY 88	4400	6.2	43	3.5

The water quality data for this site exhibited a trend of increasing concentration during dry years (Chilcott et al., 1989). Table 1 shows the median constituent concentrations for various drains to Salt Slough during water years 85, 86, 87 and 88. The Salt Slough Ditch concentrations showed an increasing salinity however, the median concentrations for selenium remained relatively constant showing a low input of subsurface drainage water. The best quality water found in the Ditch occurs during the intensive irrigation period when flows are also highest. Poor quality is found during the low flow winter or non-irrigation period.

The San Luis Canal Company has conducted similar monitoring on Wood Slough, a main tributary to Salt Slough Ditch upstream of Hereford Road and it also shows low constituent concentrations (Pers Comm). In addition to Wood Slough, the Canal Company also monitors the San Juan Drain and the Poso Drain, both of which enter Salt Slough Ditch upstream of Hereford Road. The quality of each reflects minimal inflow of selenium laden subsurface agricultural drainage water as each shows consistently low selenium concentrations. The Poso Drain does carry poorer quality water than the other tributaries especially for salt and boron however the flow has always been low enough that no strongly elevated concentrations have been noted at the Hereford Road Site. Table 2 summarizes the Canal Company data.

West Delta Drain

No water quality sampling has been done on the West Delta Drain because of the limited area that it drains and the lack of subsurface tile drainage systems in this area. The quality of the West Delta Drain can best be described by the quality of the Low Water Channel as sampled by the San Luis Canal Company (Table 2). The data in this table indicate that the West Delta Drain shows a quality similar to the San Juan Drain which is also a drain of limited service area and principally within the San Luis Canal Company. The slightly higher boron concentration is likely due to the closer proximity of the West Delta Drain to the Grassland Area, an area of known high boron.

Mud Slough (south)

Mud Slough (south) carries a large quantity of subsurface agricultural drainage water into Salt Slough. This drainage water originates to the south of the Grassland Area, flows through the South Grassland Area and finds its way into Mud Slough (south) through a variety of discharge points. The quality of Mud Slough (south) south or upstream of Henry Miller Road has not been monitored. The quality however will likely be similar to the quality found at the Boundary Drain (Table 1 and 2). Little if any subsurface drainage water finds its way into the Slough prior to this point.

The remainder of the Slough (downstream of Henry Miller Road) is entirely within the Los Banos State Waterfowl Management Area. A large number of discharges enter the Slough in this stretch. These include the Santa Fe Diversion, City Ditch and the Boundary Drain. Two of these discharges, City Ditch and the Santa Fe Diversion carry significant quantities of subsurface agricultural drainage water. As shown in Table 1, both the systems show elevated salinity, boron and selenium. The source of this water is normally the Camp 13 Ditch which carries the drainage water from south of the Grassland Area through the Grassland Area to be discharged through either of these drains. The third drain entering Mud Slough (south) in this reach is the Boundary Drain. It is characterized by much lower salinity, boron and selenium and provides dilution of the drainage flows.

Table 2 Median Constituent Concentration for Area Drains within the San Luis Canal Company from January 1985 to August 1989 (San Luis Canal Company files).

<u>Site</u>	<u>EC</u> <u>μmhos/cm</u>	<u>B</u> <u>mg/L</u>	<u>Se</u> <u>μg/L</u>
Poso Slough @ Eucalyptus	1,950	0.56	<2
Wood Slough @ Orchard Ditch	1,300	0.22	<2
San Juan Drain @ Maintenance Road	1,500	0.23	<2
Low Water Channel	1,500	0.37	<2
Boundary Drain @ DFG Pumps	2,100	0.57	<2

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*Sites with North & West designations are on same side of Ditch
 Sites with South & East designations are on same side of Ditch

Index to Salt Slough Ditch Discharge & Diversion Sites

Site	Mile	Description
SSD001	0.00S	Wood Slough/Santa Rita Slough discharge
SSD002	0.00S	Large lift pumps to irrigation canal
SSD003	0.02E	Large field drain from cropland
SSD004	0.08W	field drain from cropland
SSD005	0.11E	field drain from cropland
SSD006	0.17W	field drain from cropland
SSD007	0.22E	field drain from cropland
SSD008	0.39W	field drain from cropland
SSD009	0.43E	field drain from cropland
SSD010	0.51E	Large field drain from cropland
SSD011	0.57W	field drain from cropland
SSD012	0.68E	field drain from cropland
SSD013	0.73S	field drain from cropland
SSD014	0.81S	Large field drain from cropland
SSD015	0.81N	field drain from cropland
	0.82	Pipeline across Salt Slough Ditch
SSD016	1.01N	field drain from cropland
SSD017	1.11S	field drain from cropland
SSD018	1.14N	Large field drain from cropland
SSD019	1.21N	field drain from cropland
SSD020	1.23N	field drain from cropland
SSD021	1.32S	field drain from cropland
SSD022	1.55N	field drain from cropland
SSD023	1.55S	Large field drain from cropland
	1.56	Elgin Avenue
SSD024	1.57S	field drain from cropland
SSD025	1.67N	field drain from cropland
SSD026	1.84N	field drain from cropland
SSD027	1.87N	field drain from cropland
SSD028	1.93S	field drain from cropland
SSD029	1.94N	field drain from cropland
SSD030	1.95N	Large field drain from cropland
SSD031	1.96N	Lift pump for irrigation of cropland
SSD032	2.01S	Large field drain from cropland
SSD033	2.04S	field drain from cropland
SSD034	2.15N	two field drains from cropland
SSD035	2.16N	field drain from cropland
SSD036	2.26S	field drain from cropland
SSD037	2.32N	field drain from cropland
SSD038	2.41S	field drain from cropland
SSD039	2.44N	field drain from cropland
SSD040	2.47N	field drain from cropland
SSD041	2.56N	field drain from cropland
SSD042	2.65S	field drain from cropland
SSD043	2.74N	field drain from cropland
SSD044	2.77S	West Santa Rita Drain

Index to Salt Slough Ditch Discharge & Diversion Sites

Site	Mile	Description
SSD045	2.86S	irrigation spill
SSD046	2.97S	field drain from pasture land
SSD047	3.00N	Large field drain
SSD048	3.17S	field drain from pasture and duck pond
SSD049	3.31N	Large field drain from pasture land
SSD050	3.32S	field drain from pasture land
SSD051	3.51S	field drain from pasture land
SSD052	3.56N	Large field drain
SSD053	3.56S	San Juan Drain
SSD054	3.64S	field drain from cropland
SSD055	3.85S	Lift pump to San Juan Canal
SSD056	3.87S	irrigation spill from San Juan Canal
SSD057	3.97S	irrigation spill
SSD058	4.05S	field drain from cropland
SSD059	4.67S	Large field drain from cropland
SSD060	4.69S	field drain from cropland
SSD061	4.70W	Old Salt Slough Ditch Channel: carries crop drainage water
SSD062	4.87W	Large field drain from cropland
SSD063	4.97E	lift pump to irrigation ditch
SSD064	5.01E	Pick Anderson Bypass
SSD065	5.02N	irrigation spill
SSD066	5.13N	lift pump to irrigation ditch
SSD067	5.21N	Large field drain from cropland
SSD068	5.58N	Large field drain from cropland
SSD069	5.92S	Large field drain from cropland
SSD070	5.94S	Large field drain from cropland
SSD071	5.95S	Lift pump to irrigation ditch
SSD072	5.97S	irrigation spill from ditch
SSD073	6.03N	Large field drain from cropland
SSD074	6.21N	Large field drain from cropland
SSD075	6.24S	field drain from cropland
SSD076	6.38S	field drain from cropland
SSD077	6.43N	Large field drain from cropland
SSD078	6.51N	field drain from cropland
SSD079	6.65N	field drain from cropland
SSD080	6.72S	Poso Drain
	6.73	Turner Island Road
SSD081	6.74N	Lift pumps to Siphon Ditch
SSD082	6.92N	field drain from cropland
SSD083	6.93N	field drain from cropland
SSD084	6.93S	Lift pump to irrigation ditch
SSD085	6.94S	Large field drain from cropland
SSD086	6.95N	Lift pump to irrigation ditch
SSD087	7.11N	field drain from cropland
SSD088	7.13N	field drain from cropland
SSD089	7.14S	Large field drain from cropland
SSD090	7.24N	field drain from cropland
SSD091	7.25S	field drain from cropland

Index to Salt Slough Ditch Discharge & Diversion Sites

Site	Mile	Description
SSD092	7.38N	field drain from cropland
SSD093	7.39N	field drain from cropland
SSD094	7.48S	Portable lift pump to cropland
SSD095	7.49S	Lift pump to cropland
SSD096	7.54N	field drain from cropland
SSD097	7.92S	large field drain from cropland
SSD098	7.93S	field drain from cropland
SSD099	7.93N	Lift pump to irrigation ditch
SSD100	8.13S	Large field drain from cropland
SSD101	8.28N	field drain from cropland (corrugated pipe)
SSD102	8.29N	field drain from cropland (PVC pipe)
SSD103	8.32N	field drain from cropland
SSD104	8.33S	Lift pump to irrigation ditch
SSD105	8.53N	field drain from cropland
SSD106	8.63N	field drain from cropland
SSD107	8.74N	field drain from cropland
SSD108	8.80N	field drain from cropland
SSD109	8.83S	Portable lift pump
SSD110	8.89N	field drain from cropland
SSD111	9.03S	irrigation spill
SSD112	9.06N	Portable lift pump
SSD113	9.16N	field drain from cropland
SSD114	9.26N	field drain from cropland
SSD115	9.27N	field drain from cropland
SSD116	9.29S	field drain from cropland
SSD117	9.50N	Large drain
SSD118	9.51N	Lift pump to Island Canal
SSD119	9.64S	Large natural channel-drains pasture and cropland
SSD120	10.12S	Large drain from field cropland
SSD121	10.12N	Lift pump to Delt Island Canal
	10.13	Delta Island Canal Overcrossing
SSD122	10.14S	Irrigation spill form Delta Island Canal
SSD123	10.25S	field drain from cropland
SSD124	10.27N	field drain from cropland
SSD125	10.32N	field drain from cropland
SSD126	10.33S	field drain from cropland
SSD127	10.33N	Large field drain from cropland
	10.40	Hereford Road
SSD128	10.41N	field drain from cropland
SSD129	10.41S	field drain from cropland
SSD130	10.46N	field drain from cropland
SSD131	10.55S	field drain from cropland
SSD132	10.60N	field drain from cropland
SSD133	10.65N	field drain from cropland
SSD134	10.71N	field drain from cropland
SSD135	10.75S	field drain from cropland
SSD136	10.80N	Lift pump to irrigation ditch
SSD137	10.81S	field drain from cropland
SSD138	10.93	Salt Slough Ditch discharge to Salt Slough at Sand Dam

West Delta Drain Discharge and Diversion Sites

Site	Mile	Description
0.00		Beginns at Carlucci Road
		West Delta Drain begins as a small tailwater drain
WDD001	0.58E	Irrigation spill from West Delta Canal
WDD002	0.90W	Field drain from cropland
WDD003	0.99W	Field drain from cropland
WDD004	1.42E	Large field drain from cropland
WDD005	1.50E	Field drain from cropland
WDD006	1.54W	Field drain from cropland
WDD007	1.58W	Field drain from cropland
WDD008	1.72W	Field drain from cropland
	1.77	Turner Island Road
WDD009	1.78W	Large field drain from cropland
WDD010	1.80W	Field drain from cropland
WDD011	1.82E	Field drain from cropland
WDD012	1.85W	Field drain from cropland
WDD013	1.91W	Field drain from cropland
WDD014	1.93E	Large field drain from cropland
WDD015	1.94W	Field drain from cropland
WDD016	1.97E	Field drain from cropland
WDD017	2.01E	Large field drain from cropland
WDD018	2.04W	Field drain from cropland
WDD019	2.08W	Field drain from cropland
WDD020	2.10E	Field drain from cropland
WDD021	2.23W	Field drain from cropland
WDD022	2.37E	Field drain from cropland
	2.40	Deep Well Road
WDD023	2.43W	Large field drain from cropland
WDD024	2.66E	Field drain from cropland
WDD025	2.72W	Field drain from cropland
WDD026	2.78W	Field drain from cropland
WDD027	2.78E	Field drain from cropland
WDD028	2.85W	Field drain from cropland
WDD029	3.02E	Irrigation spill from West Delta Ditch
WDD030	3.15W	Field drain from cropland
	3.17	Box Car Road
WDD031	3.18W	Large field drain from cropland
WDD032	3.34W	Large field drain from cropland
WDD033	3.40W	Field drain from cropland
WDD034	3.40E	Lift pump to West Delta Canal
	3.44	Henry Miller Road
WDD035	3.57E	Field drain from cropland
WDD036	3.64E	Field drain from cropland
WDD037	3.68E	Field drain from cropland
WDD038	3.78E	Field drain from cropland
WDD039	3.83E	Field drain from cropland
	3.84	Delta Road
WDD040	3.85E	Field drain from cropland
WDD041	3.85W	Field drain from cropland
WDD042	3.88W	Field drain from cropland
WDD043	3.96W	Field drain from cropland

West Delta Drain Discharge and Diversion Sites

Site	Mile	Description
WDD044	4.05E	Field drain from cropland
WDD045	4.24E	Field drain from cropland
WDD046	4.32W	Field drain from cropland
WDD047	4.40E	Field drain from cropland
WDD048	4.41W	Field drain from cropland
WDD049	4.45E	Field drain from cropland
WDD050	4.47W	Field drain from cropland
WDD051	4.50E	Field drain from cropland
WDD052	4.54W	Field drain from cropland
WDD053	4.60W	Field drain from cropland
WDD054	4.71E	Large field drain from cropland
WDD055	4.74E	Irrigation spill from West Delta Drain
WDD056	4.79W	Field drain from cropland
WDD057	4.81E	Field drain from cropland
WDD058	5.03W	Large field drain from cropland - water can be recycled at this point
WDD059	5.07E	Field drain from cropland
WDD060	5.16E	Field drain from cropland
WDD061	5.22E	Field drain from cropland
WDD062	5.32E	Field drain from cropland
WDD063	5.39E	Field drain from cropland
WDD064	5.51E	Field drain from cropland
WDD065	5.72E	Field drain from cropland
WDD066	5.77W	Large gated drain from Los Banos State Waterfowl Area
WDD067	5.82E	Field drain from cropland
WDD068	5.86	West Delta Canal overcrossing - can spill into drain
WDD069	6.05W	Large field drain from cropland
WDD070	6.08E	Large field drain from cropland
WDD071	6.18E	Large field drain from cropland
WDD072	6.27E	Field drain from cropland
WDD073	6.36E	Field drain from cropland
WDD074	6.52E	Field drain from cropland
WDD075	6.78E	Pump from West Delta Drain to Salt Slough Ditch
WDD076	6.81	West Delta Drain discharge to Salt Slough

Mud Slough (south) Discharge and Diversion Sites

Site	Mile	Description
MSS001	0.00	Camp 13 Slough discharge to Mud Slough (south)
MSS002	0.02W	Large duck pond drain
MSS003	0.32E	Gated outlet from large duck pond drain
MSS004	0.68W	Gadwall Canal discharge
MSS005	0.98W	Lift pump to duck pond
MSS006	1.85W	Mud Slough Bypass diversion from Slough - Gate allows flow to original Mud Slough channel
MSS007	1.87W	Makin Tile Drain
MSS008	2.13E	Lift pump for irrigation of pasture land
MSS1	2.14	Mud Slough (south) check structure #1
MSS009	2.66E	Gated outlet from Agatha Canal to Mud Slough (south) - used for stockwatering
	2.67	Mud Slough (south) siphons under the Agatha & Arroyo Canals
	3.20	State Highway 152
	8.20	Henry Miller Avenue
MSS010	8.31E	Duck Pond drain
MSS011	8.78E	Gated outlet from San Pedro Canal
MSS012	9.24E	2 large pumps from Boundary Drain - used so that Boundary Drain does not back up to farmers land
MSS013	9.51E	Boundary Drain discharge
MSS014	9.87E	Gated outlet from Los Banos Waterfowl Area duck pond
MSS015	9.97W	Large duck pond drain from Los Banos Waterfowl Area
MSS016	10.44W	Large gated duck pond drain from Los Banos Waterfowl Area
MSS017	10.46W	City Ditch discharge
MSS018	10.68E	Duck pond drain from Los Banos Waterfowl Area
MSS019	10.81E	Duck pond drain from Los Banos Waterfowl Area
MSS020	11.75E	Drain from Little Buttonwillow Lake
MSS021	12.06W	Duck pond drain from Los Banos Waterfowl Area
MSS022	12.28W	Duck pond drain from Los Banos Waterfowl Area
MSS023	12.67W	Duck pond drain from Los Banos Waterfowl Area
MSS024	12.80W	Duck pond drain from Los Banos Waterfowl Area
MSS025	12.84W	Duck pond drain from Los Banos Waterfowl Area
MSS026	13.29W	Drain from pasture land
MSS027	13.62	Mud Slough (south) discharge to Salt Slough

APPENDIX B
Water Quality Data for Selected Sites on
Tributaries to Salt Slough

Salt Slough Ditch at Hereford Road	20
Boundary Drain at DFG pumps	23
City Ditch at Los Banos State Waterfowl Management Area	26
Mud Slough Diversion	28
Camp 13 Drain at CCID Main	30

TRACE ELEMENT WATER QUALITY DATA

SALT SLOUGH DITCH AT HEREFORD ROAD

LOCATIONLatitude 37 08' 30", Longitude 120 45' 17"
 NW 1/4, NE 1/4, NW 1/4, Sec. 22, T.9S., R.11E.,
 3.0 miles N on Hereford Road from Henry Miller Road.

DATE	TIME	Se	Mo	Cu	Cr	Ni	Pb	Zn	Hg
.....ug/L.....									
Total Recoverable									
06/14/85	0935	0.0							
07/02/85	1010	1.0							
08/15/85	1100	1.0							
08/29/85	0820	<1.0							
09/28/85	1235	1.0							
10/31/85	1150	<1.0							
12/07/85	1405	1.0	12	<1	2	5	<5		<0.5
01/04/86	1230	1.0	7	<1	3	15	<5		<0.2
01/14/86	1550	1.0	10	<1	<1	6	<5		0.6
02/07/86	0935	1.0	6	2	3	9	<5		<0.5
02/17/86	0805	1.0	<5	5	27	18	<5		<0.5
03/02/86	1240	1.0	6	5	4	13	<5		<0.5
04/02/86		<1.0							
04/19/86	0915	<1.0	<5	3	13	17	<5		<0.5
04/26/86	1540	<1.0		3	3	5	<5	8	<0.2
05/13/86	1045	<1.0	<5	1	2	6	<5		<0.5
06/03/86	1540	0.8	4	10	<1	6	<5		<0.5
06/16/86	1700	3.6	<5	8	22	11	<5	23	<0.5
06/26/86	1345	1.2	<5	5	5	10	<5	22	<0.5
08/04/86	1600	1.3	<5	5	1	9	<5	21	<0.5
09/02/86	1210	0.9	<5	5	4	7	<5	22	<0.5
09/27/86	1525		<5	5	7	8	<5	13	<0.5
11/03/86	1415	1.1	2	6	6	7	<5	8	
12/04/86		1.2	<5	<1	<1	<5	<5	<1	<0.5
01/02/87	1540	1.2	8	2	1	<5	<5	2	<0.5
01/30/87	1210	2.0	5						
02/27/87	1140	2.8							
04/01/87	1145	2.2							
05/01/87	1305	2.0							
06/01/87	1345	2.0	3						
07/01/87	1045	1.0	4						
07/31/87	1150	1.4	3						
09/01/87	1135	1.0	3						
10/01/87	1140	1.1	3						
11/03/87	1300	0.6	4						
12/01/87	1425	0.6	7						
01/05/88	1230	1.1	6						
01/27/88	1655	0.4							
03/09/88	1310	1.7							

TRACE ELEMENT WATER QUALITY DATA

SALT SLOUGH DITCH AT HEREFORD ROAD (cont.)

DATE		Se	Mo	Cu	Cr	Ni	Zn
	ug/L.....					
		Total Recoverable					
85 WY*	MIN	<1					
	MED	1					
	MAX	1					
	# DATA	5					
86 WY*	MIN	0.8	4.4	<1	<1	5	8
	MED	1	<5	5	3	9	22
	MAX	3.6	12	10	27	18	23
	# DATA	16	14	15	15	15	6
87 WY*	MIN	1	2	<1	<1	<5	<1
	MED	1.4	3	2	1	<5	2
	MAX	2.8	8	6	6	7	8
	# DATA	11	8	3	3	3	3
88 WY*	MIN	0.4	3				
	MED	0.9	5				
	MAX	1.7	7				
	# DATA	6	4				
TOTAL	MIN	<1	2	<1	<1	<5	<1
	MED	1	3	4	3	8	13
	MAX	3.6	12	10	27	18	23
	# DATA	38	36	18	18	18	9

* Water year: extending from 1 October of one year to 1 October
of the following year

.....Salt Slough Ditch at Hereford Road (MER528)

LocationLatitude 37 08'30", Longitude 120 45'17". In NW 1/4, NE 1/4, NW 1/4,
Sec. 22, T. 9S. R. 11E. 3.0 mi. N on Hereford Rd from Henry Miller Rd.

Date	Time	ph	EC	Se	Mo	B	Cl	SO4	CO3	HCO3	Total	
			umhos/cm	...ug/L...							Alk	Temp
10/01/87	1140	7.6	1050	1.1	3	0.30	170	100			130	74
11/03/87	1300	8.2	1150	0.6	4	0.35	190	140	0	150	150	58
12/01/87	1425	7.8	1620	0.6	7	0.48	200	210	0	200	200	56
01/05/88	1230	7.9	1950	1.1	6	0.43	220	220	0	290	290	53
01/27/88	1655	7.5	1800	0.4		0.26	290	180	0	210	210	58
03/09/88	1310		1150	1.7		0.30	150	140	<1	150	150	60
03/30/88	1255	7.9	1150	2.0		0.32	150	140	<1	160	160	58
05/05/88	1525	7.7	1150	2.0		0.40	150	150	<1	140	140	60
06/01/88	1315	7.6	950	1.8		0.40	130	120	<1	130	130	72
06/29/88		7.7	1050	1.0		0.40	140	120	<1	130	130	67
08/01/88		8.3	900	1.2		0.26	140	80	<1	90	90	87
09/01/88	1350		1130	1.4		0.42	180	130	<1	140	140	82
=====												
WY 88	Min	7.5	900	0.40	3	0.26	130	80	0	90	90	53
	Med	7.8	1150	1.2	5	0.38	160	140	<1	150	150	60
	Max	8.3	1950	2.0	7	0.48	290	220	<1	290	290	87
	Count	10	12	12	4	12	12	12	11	11	12	12

TRACE ELEMENT WATER QUALITY DATA

BOUNDARY DRAIN AT DEPARTMENT OF FISH AND GAME PUMP

LOCATIONLatitude 37 06'32", Longitude 120 46'45"
 In NE 1/4, SE 1/4, NE 1/4, Sec. 32, T.9S., R.11E.,
 N of Henry Miller Road, 4.6 miles NE of Los Banos.

DATE	TIME	Se	Mo	Cu	Cr	Ni	Pb	Zn	Hg
.....ug/L.....									
Total Recoverable									
06/14/85	0915	1.0							
08/15/85	1040	1.0							
08/29/85	0800	<1							
09/28/85	1210	1.0							
10/31/85	1130	<1							
12/07/85	1350	1.0	16	9	1	17	<5		<0.5
01/04/86	1210	<1	19	11	1	33	<5		<0.2
01/14/86	1500	<1	11	3	2	23	<5		<0.5
03/02/86	1215	<1	8	4	2	7	<5		<0.5
04/02/86		<1							
04/03/86		12	6						
04/26/86	1555	<1		9	4	15	<5	14	<0.2
06/03/86	1600	0.9							
06/26/86	1400	1.3	<5	5	16	9	<5	19	<0.5
08/04/86	1620	1.1	<5	8	1	8	<5	17	<0.5
09/02/86	1220	1.1	<5	4	2	5	<5	14	<0.5
09/27/86	1540		<5	7	5	8	<5	14	<0.5
11/03/86	1400	1.5	4	6	6	7	<5	7	
12/04/86	1500	1.6	<5	<1	<1	<5	<5	<1	<0.5
01/02/87	1555	1.6	8	2	<1	<5	<5	3	<0.5
01/30/87	1230	0.5	15						
02/27/87	1155	2.0							
04/01/87	1200	2.1							
05/01/87	1315	1.9							
06/01/87	1400	1.7	4						
07/01/87	1015	1.8	4						
07/31/87	1125	1.5							
09/01/87	1115	1.4							
10/01/87	1125	1.5	4						
11/03/87	1315	0.5	6						
12/01/87	1410	1.2	12						
01/05/88	1245	0.3							
01/27/88	1635	0.5							
03/09/88	1325	1.9							
<hr/>									
85 WY*	MIN	<1							
	MED	1							
	MAX	1							
	# DATA	4							
<hr/>									
86 WY*	MIN	1	<5	3	1	5		14	
	MED	1	6	7	2	9		14	
	MAX	12	19	11	16	33		19	
	# DATA	12	9	9	9	9		5	

TRACE ELEMENT WATER QUALITY DATA

BOUNDARY DRAIN AT DEPARTMENT OF FISH AND GAME PUMP (cont.)

DATE		Se	Mo	Cu	Cr	Ni	Zn
	ug/L.....					
		Total Recoverable					
87 WY*	MIN	0.5	4	<1	<1	<5	<1
	MED	1.6	4	2	<1	<5	3
	MAX	2.1	15	6	6	7	7
	# DATA	11	6	3	3	3	3
88 WY*	MIN	0.3	4				
	MED	0.9	6				
	MAX	1.9	12				
	# DATA	6	3				
TOTAL	MIN	<1	4	<1	<1	<5	<1
	MED	1.1	5	6	2	8	14
	MAX	12	19	11	16	33	19
	# DATA	33	18	12	12	12	8

* Water year: extending from 1 October of one year to 1 October
of the following year

.....Boundary Drain at Department of Fish and Game Pump (MER521)

LocationLatitude 37 06'32", Longitude 120 46'45". In NE 1/4, SE 1/4, NE 1/4,
Sec. 32, T. 9S., R. 11E. North of Henry Miller Rd., 4.6 mi. NE of
Los Banos.

Date	Time	ph	EC umhos/cm	Seug/L....	Mo	B	Cl	SO4	CO3	HCO3	Total Alk.	Temp
10/01/87	1125	7.4	1470	1.5	4	0.48	230	150			140	72
11/03/87	1315	8.0	1500	0.5	6	0.65	260	190	0	120	120	61
12/01/87	1410	7.3	3270	1.2	12	1.4	530	470	0	180	180	59
01/27/88	1635	7.5	2700	0.5		0.87	440	290	0	290	290	59
03/09/88	1325		1650	1.9		0.60	220	240	<1	150	150	60
03/30/88	1310	7.6	1850	1.8		0.68	280	270	<1	150	150	59
05/05/88	1545	7.6	1350	1.9		0.50	180	180	<1	120	120	62
06/01/88	1335	7.5	1300	1.4		0.50	190	160	<1	130	130	74
06/29/88		7.5	1250	1.5		0.40	180	150	<1	110	110	69
08/01/88		7.8	1150	1.1		0.33	180	110	<1	110	110	80
09/01/88	1415		1370	1.4		0.39	230	160	<1	120	120	83
=====												
WY 88	Min	7.3	1150	0.5	4	0.33	180	110	0	110	110	59
	Med	7.5	1470	1.4	6	0.50	230	180	<1	130	130	62
	Max	8.0	3270	1.9	12	1.4	530	470	<1	290	290	83
	Count	9	11	11	3	11	11	11	10	10	11	11

TRACE ELEMENT WATER QUALITY DATA

CITY DITCH (SAN LUIS WASTEWAY TO MUD SLOUGH)

LOCATIONLatitude 37 07' 44", Longitude 120 48' 53"; In
 SW 1/4, SW 1/4, SW 1/4, Sec. 19, T.9S., R.11E.,
 2.2 miles N of Los Banos Wildlife Refuge Office.

DATE	TIME	Se	Mo	Cu	Cr	Ni	Pb	Zn	Hg
.....ug/L.....									
Total Recoverable									
05/02/85	1330	30							
06/03/85	1200	16							
07/02/85	0940	24							
08/15/85	1020	16							
08/29/85	0740	18							
10/31/85	1110	12							
12/07/85	1325	27	17	6	7	16	<5		<0.5
01/04/86	1145	42	21	19	8	34	<5		<0.2
01/14/86	1420	23	11	3	14	33	<5		<0.5
02/17/86	0745	32	8	26	17	52	<5		<0.5
03/02/86	1155	34	8	10	18	30	<5		<0.5
04/02/86		27							
04/03/86		31	5	15	27	22	<10	36	
04/19/86	0850	32	6	6	12	15	<5		<0.5
04/26/86	1615	33		11	23	35	<5	16	<0.2
05/13/86	1030	27	6	4	5	8	<5		<0.5
08/05/86	1130	25	<5	8	6	15	<5	29	<0.5
09/02/86	1250	22	<5	9	12	22	<5	41	<0.5
09/27/86	1615		<5	7	12	11	<5	17	<0.5
12/04/86	1410	41	<5	<1	15	11	<5	21	<0.5
01/02/87	1635	35	9	4	9	7	<5	6	<0.5
02/27/87	1215	50	14	4	19	11	<5	15	
04/01/87	1215	47	13	4	12	9	<5	16	
09/01/87	1055	29		12	29	22	6	34	
01/05/88	1210	40		7	23	12	<5	22	
03/09/88	1345	43		19	56	35	6	53	
<hr/>									
85 WY*	MIN	16							
	MED	18							
	MAX	30							
	# DATA	5							
<hr/>									
86 WY*	MIN	12	<5	3	5	8		16	
	MED	27	6	9	12	27		29	
	MAX	42	21	26	27	52		41	
	# DATA	13	11	12	12	12		5	
<hr/>									
87 WY*	MIN	29	<5	<1	9	7		6	
	MED	41	11	4	15	11		16	
	MAX	50	14	12	29	22		34	
	# DATA	5	4	5	5	5		5	

.....City Ditch (San Luis Wasteway to Mud Slough) (MER543)

LocationLatitude 37 07'44", Longitude 120 48'53". In SW 1/4,SW 1/4, SW 1/4, Sec. 19, T.9S.,
R.11E. 2.2 mi. N of Los Banos Wildlife Refuge.

Date	Time	pH	EC umhos/cm	Se	Cu	Cr	Ni	Pb	Zn	B	Cl	SO4	CO3	HCO3	Alk.	Temp
										Totalmg/L.....						
03/09/88	1345		3400	43	19	56	35	6	53	4.7	430	930	<1	180	180	61
03/30/88	1330	7.9	3300	41						4.4	380	830	<1	170	170	60
06/01/88	1400	7.8	2500	24	10	18	17	<5	20	3.6	280	600	<1	120	120	73
06/29/88		8.0	3250	36	18	14	39	<5	52	4.4	370	790	<1	160	160	68
=====																
WY 88	Min	7.8	2500	24	10	14	17	<5	20	3.6	280	600	<1	120	120	60
	Med	7.9	3280	39	18	18	35	<5	52	4.4	380	810	<1	170	170	65
	Max	8.0	3400	43	19	56	39	6	53	4.7	430	930	<1	180	180	73
	Count	3	4	4	3	3	3	3	3	4	4	4	4	4	4	4

TRACE ELEMENT WATER QUALITY DATA

SANTA FE CANAL-MUD SLOUGH DIVERSION AT HENRY MILLER ROAD

LOCATIONLatitude 37 05' 59", Longitude 120 49'11"
 NW 1/4, NE 1/4, NE 1/4, Sec. 1, T.10S., R.10E.,
 On Henry Miller Rd. 0.8 miles E of Mercy Springs Rd.

DATE	TIME	Se	Mo	Cu	Cr	Ni	Pb	Zn	Hg
.....ug/L.....									
Total Recoverable									
01/14/86	1445	25	11	4	8	5	<5		<0.5
02/07/86	0905	35	12	13	23	32	<5		<0.5
03/02/86	1135	37	12	4	7	12	<5		<0.5
04/26/86	1640	32		5	11	17	<5	2	<0.2
06/26/86	1415	25	<5	5	25	12	<5	12	<0.5
08/05/86	1115	27	12	3	<1	4	<5	3	<0.5
09/02/86	1235	24	8	2	<1	<5	<5	3	<0.5
09/27/86	1600		<5	6	10	9	<5	14	<0.5
11/03/86	1345	19	8	7	12	13	<5	11	
01/02/87	1615	29	13	2	5	<5	<5	6	<0.5
01/30/87	1145	32	15	2	1	<5	<5	12	<0.5
05/01/87	1330	34	7	6	16	15	<5	25	
06/01/87	1415	33		5	13	9	<5	13	
07/01/87	1000	23		18	55	35	16	48	
07/31/87	1105	32		8	14	10	<5	19	
10/01/87	1110	44		5	16	14	<5	16	
11/03/87	1325	9.5		3	5	6	<5	8	
01/27/88	1620	49		5	20	8	<5	9	
<hr/>									
86 WY*	MIN	24	<5	2	<1	<5		2	
	MED	27	11	5	5	11		3	
	MAX	37	12	13	25	32		14	
	# DATA	7	7	8	8	8		5	
87 WY*	MIN	19	7	2	1	<5		6	
	MED	32	11	6	13	10		13	
	MAX	34	15	18	55	35		48	
	# DATA	7	4	7	7	7		7	
88 WY*	MIN	9.5		3	5	6		8	
	MED	44		5	16	8		9	
	MAX	49		5	20	14		16	
	# DATA	3		3	3	3		3	
TOTAL	MIN	9.5	<5	2	<1	<5		2	
	MED	32	6	5	12	10		12	
	MAX	49	15	18	55	35		48	
	# DATA	17	11	18	18	18		15	

* Water Year: extending from 1 October of one year to 1 October
 of the following year.

.Santa Fe - Mud Slough Diversion at Henry Miller Road (MER548)

LocationLatitude 37 05'59", Longitude 120 49'11". In NW 1/4, NE 1/4, NE 1/4, Sec. 1, T.10S.,
R.10E. On Henry Miller Rd. 0.8 mi. E of Mercy Springs Rd.

Date	Time	pH	EC umhos/cm	Se	Cu	Cr	Ni	Pb	Zn	B	Cl	SO4	CO3	HCO3	Total	
															Alk.	Temp
10/01/87	1110	8.1	2950	44	5	16	14	<5	16	4.2	360	660			140	74
11/03/87	1325	8.6	2350	9.5	3	5	6	<5	8	3.6	340	570	0	170	170	62
01/27/88	1620	8.0	3850	49	5	20	8	<5	9	5.0	440	950	0	180	180	52
05/05/88	1555	8.0	3650	44	6	20	11	<5	13	4.9	390	900	<1	150	150	60
08/01/88		8.1	2700	28	4	4	6	<5	8	3.4	330	610	<1	150	150	83
09/01/88	1425		2850	31	4	5	6	<5	5	3.6	380	670	<1	150	150	90
10/04/88	1230		2000	24	6	11	11	<5	16	2.0	250	410	<1	120	120	70
11/01/88	1250	8.2	1740	11	2	2	<5	<5	6	1.7	230	310	<1	120	120	68
12/08/88	1400		2660	26	4	7	6	<5	8	3.5	300	180	<1	150	150	53
=====																
WY 88	Min	8.0	2350	9.5	3	4	6	<5	5	3.4	330	570	0	150	140	52
	Med	8.1	2800	38	5	11	7	<5	9	3.9	370	670	<1	150	150	68
	Max	8.6	3850	49	6	20	14	<5	16	5.0	440	950	<1	180	180	90
	Count	5	6	6	6	6	6	6	6	6	6	6	5	5	6	6

Total	Min	8.0	1740	9.5	2	2	<5	<5	5	1.7	230	180	0	120	120	52
	Med	8.1	2700	28	4	7	6	<5	8	3.6	340	610	<1	150	150	68
	Max	8.6	3850	49	6	20	14	<5	16	5.0	440	950	<1	180	180	90
	Count	6	9	9	9	9	9	9	9	9	9	9	8	8	9	9

TRACE ELEMENT WATER QUALITY DATA

CAMP 13 SLOUGH AT GAUGE STATION

LOCATIONLatitude 36 56'04", Longitude 120 41'06"
 In SE 1/4, SE 1/4, SW 1/4, Sec. 27, T.11S., R.11E.,
 150 ft. N of CCID Main Canal, 6.4 miles W of Russell Ave.,
 9.2 miles S-SE of Los Banos, 6.7 miles W-SW of South Dos Palos.

DATE	TIME	Se	Mo	Cu	Cr	Ni	Pb	Zn	Hg
.....Ug/L.....									
Total Recoverable									
05/02/85	0910	53							
06/03/85	1000	28							
07/02/85	0658	48							
08/15/85	0710	35							
08/28/85	1555	29							
09/28/85	0815	17	4						
10/31/85	0745	59							
12/07/85	0755	19	6	2	2	11	<5		<0.5
01/04/86	0800	43	2	11	15	13	<5		<0.2
01/14/86	1045	54	6	13	36	38	<5		<0.5
02/01/86	1525	44	7	5	14	26	<5		<0.5
03/02/86	0810	74	11	18	25	26	<5		<0.5
04/02/86		59							
04/27/86	0750	61		7	14	30	<5	9	<0.2
06/04/86	0800	37	2						
06/26/86	1615	41	<5	5	24	11	<5	14	<0.5
08/05/86	0825	30	<5	8	3	26	<5	34	<0.5
09/02/86	1545	36	<5	5	8	11	<5	16	<0.5
09/28/86	0810	13	<5	6	8	12	<5	18	<0.5
11/03/86	1150	43	4	14	30	17	<5	26	
12/04/86	1220	44	<5	11	38	13	<5	19	<0.5
01/03/87	0800	43	6	5	6	7	<5	7	<0.5
02/27/87	1320	62							
04/01/87	1415	64							
05/01/87	1440	39							
06/01/87	1515	40	8						
07/01/87	0735	53	1						
07/31/87	0805	37	6						
09/01/87	0820	38	9						
10/01/87	0855	46	10						
11/03/87	1430	4.5	5						
12/01/87	1525	9.1	2						
01/27/88	1345	79							
03/09/88	1435	92							
<hr/>									
85 WY*	MIN	17	4						
	MED	32	4						
	MAX	53	4						
	# DATA	6	1						
<hr/>									
86 WY*	MIN	13	2	2	2	11		9	
	MED	43	<5	6.5	14	19.5		16	
	MAX	74	11	18	36	38		34	
	# DATA	13	10	10	10	10		5	

TRACE ELEMENT WATER QUALITY DATA

CAMP 13 SLOUGH AT GAUGE STATION (cont.)

DATE		Se	Mo	Cu	Cr	Ni	Zn
	ug/L.....					
		Total Recoverable					
87 WY*	MIN	37	1	5	6	7	7
	MED	43	6	11	30	13	19
	MAX	64	9	14	38	17	26
	# DATA	10	7	3	3	3	3
88 WY*	MIN	4.5	2				
	MED	46	5				
	MAX	92	10				
	# DATA	5	3				
TOTAL	MIN	4.5	1.0	2	2	7	7
	MED	43	<5	7	14	13	17
	MAX	92	11	18	38	38	34
	# DATA	34	21	13	13	13	8

* Water year: extending from 1 October of one year to 1 October
of the following year

Camp 13 Slough at Gauge Station (MER505)

LocationLatitude 36 56'04", Longitude 120 41'06". In SE 1/4, SE 1/4, SW 1/4,
Sec. 27, T.11S., R. 11E. 150 ft. N of CCID Main Canal, 6.4 mi. W of
Russell Ave., 9.2 mi. SE of Los Banos, 6.7 mi. SW of South Dos Palos.

Date	Time	pH	EC	Se	Mo	B	Cl	SO4	CO3	HCO3	Total	
											Alk.	Temp
			umhos/cm	...ug/L...								
10/01/87	0855	7.8	3280	46	10	5.3	380	720			150	72
11/03/87	1430	8.0	4900	4.5	5	8.0	910	1200	0	190	190	61
12/01/87	1525	8.0	1200	9.1	2	0.7	170	190	0	90	90	54
01/27/88	1345	7.7	4250	79		5.6	480	1100	0	160	160	56
03/09/88	1435		4550	92		7.1	520	1300	<1	170	170	62
03/30/88	1435	8.0	4900	74	3	6.7	560	1350	<1	160	160	61
05/05/88	1740	7.9	6700	107	5	8.6	870	1800	<1	110	110	63
06/29/88		8.4	4900	7.9	3	8.3	800	1000				78
08/01/88		8.1	2150	3.1	3	2.5	260	450	<1	140	140	83
09/01/88	1530		3190	40	4	4.3	430	770	<1	170	170	82
=====												
WY 88	Min	7.7	1200	3.1	2	0.67	170	190	0	90	90	54
	Med	8	4400	43	3.5	6.2	500	1050	<1	160	160	63
	Max	8.4	6700	107	10	8.6	910	1800	<1	190	190	83
	Count	8	10	10	8	10	10	10	8	8	9	10
